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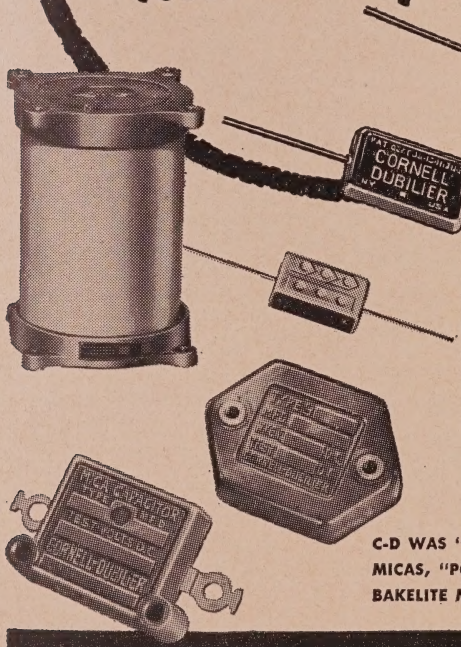


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# CORNELL DUBILIER *Capacitors*

# ELECTRONIC METAL LOCATORS

The mere mention of the term **metal locator** brings to many adventurous minds the exciting thought of prospecting for hidden treasure. This is natural because early electronic metal detectors were offered pointedly as "treasure locators," and many such instruments have been used over the years to search for buried booty — with more or less dubious results, not so much because of inadequacy of the equipment as because of false hopes of sudden wealth having little foundation.

The modern metal locator is more than a casual treasure spotter, however. Its workaday role includes such tasks as locating underground pipes, asphalt-covered railway tracks, electric wiring in walls and under floors, covered sewer tops, buried or submerged firearms, tramp metal (in lumber, foodstuffs, rubber, plastics, paper, hay, confections, tobacco, etc.), metal objects in the intestines of animals, buried military mines, and many other such prosaic applications. Indeed, hunting for buried coins, precious metals, and other ore deposits is only one, glamorous phase of metal locator use.

Locators are in present regular use by electric power companies, water works, electrical contractors, plumbing contractors, food processing mills, tobacco factories, lumber mills, textile plants, and other industrial organizations.

It is interesting to note that, although many changes have been made in metal locator circuitry and components to take advantage of new electronic developments during the past twenty years, the basic principles of their operation have remained substantially the same.

The Editors present a resume of metal locator principles in this article in response to the increased interest in this subject. From this discussion, it will be seen that the locators actually are quite simple both in theory and construction. They are useful and intriguing devices which may easily be built from a technician's own design, or from the circuits given here, often with "parts on hand."

## Operating Principle

It is convenient to divide metal locators into two categories: **Class 1** including those units embodying a separate r-f transmitter and receiver and which operate by means of a wave reflected from the transmitter to the receiver by the hidden metal, and **Class 2** including those units consisting of an r-f oscillator which becomes detuned by the metal and generates a beat-note signal. Instruments in each group may be given numerous original modifications.

**Class 1.** This is perhaps the oldest type of metal locator. It survives in many modern adaptations and has wide use. Figure 1 illustrates the operating principle. Here, a small, battery-operated radio transmitter is in the right-hand box and radiates via the loop antenna mounted perpendicular to the earth's surface. The left-hand box contains a radio receiver operated from a loop antenna mounted parallel to the earth's surface. Transmitter and receiver are tuned to the same, single operating frequency and are mounted as far apart as practicable on opposite ends of a carrying pole.

The right-angle orientation of the two loops minimizes direct pickup of the transmitter signal by the receiver. However, a portion of the radiated energy is propagated downward and penetrates the earth. If a metallic mass lies in the path of these waves, it will reflect a portion of the signal and this component will be picked up by the receiver. This pickup is indicated by a meter deflection, headphone signal, or both. Thus, operation of the receiver in-



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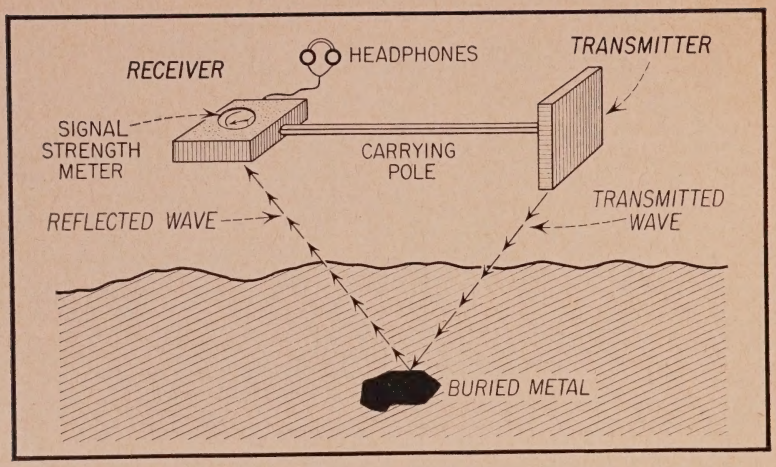



**Fig. 1. Operation of Class-1 Locator.**

dicates the presence of some metallic body under the locator, while a dead receiver shows the absence of metal.

In operation, the technician grasps the carrying pole near the center of its length and carries the locator over the area of interest, watching for the signal that announces the presence of metal. His body occupies only a small part of the space between the transmitter and receiver.

It is important to consider the problems concerning design and construction of a Class-1 metal locator. The first concerns operating power. For good penetration, the power must be as high as permissible. But since the instrument is highly portable and battery-operated, the power is restricted by weight and current limitations. Moreover, the device must not create radio interference. That is, legally it must satisfy the FCC requirement that the field strength of its transmitter at a distance from the antenna equal to $\lambda/2\pi$ must not exceed 15 microvolts per meter. (Where $\lambda$ = wavelength in meters.) Since this involves frequency, let us look briefly at frequency requirements and then return to the consideration of power.

Very high frequencies, which admittedly would permit the smallest-sized equipment, tend in general to be reflected by the earth instead of penetrating it to any great depth. They also tend to be radiated great distances from the transmitter, so can cause widespread interference. These factors outlaw their use. The most generally satisfactory frequencies have been found to be the low-frequency r-f group, e.g., 50 to 200 kc. However, useful loop antennas are ungainly in size at the lowest frequencies in this range. Nevertheless, many commercial Class-1 metal locators operate between 80 and 100 kc. Most of these instruments, when home-built, are operated between 100 and 200 kc.

Returning to the consideration of power, simple calculation will show that $\lambda/2\pi$ represents a much greater distance at 50 kc than at 50 Mc, and is greater at 100 kc than at 1000 kc. This is an added recommendation for low-frequency operation. In any event, the transmitter power must be kept low, not only because of the legal requirement but in order to minimize battery drain, reduce the weight of

the instrument, and prevent direct transmission to the receiving loop. Consequently, small receiver-type battery-operated tubes are employed in the transmitter. The plate voltage seldom exceeds 135 v in this application. If headphone operation is desired, the transmitter must be amplitude-modulated.

The receiver must be sensitive, but not so much so that it will pick up troublesome outside interference or direct transmissions from the locator's own transmitter. For this reason, the circuit usually is of the TRF type rather than a superheterodyne. The indicating meter may be operated from a diode detector. Both receiver and transmitter are fix-tuned but are adjustable over a suitable range for alignment purposes.

The receiving loop (and in some applications, the transmitting loop, as well) must be provided with a Faraday shield for protection against the capacitance effects introduced by nearby objects other than the metal of interest, otherwise false indications will be obtained.

The Class-1 instrument is the type of locator seen often in the hands of power company workers and street maintenance crews searching for mains under the street.

**Class 2.** This type of instrument operates on the beat-frequency principle. Like other beat-frequency devices, it consists of two self-excited r-f oscillators adjusted to zero beat with each other. The tank coil of one of the oscillators is employed as a search coil. When this coil is placed near a metallic body, its inductance will be changed by the latter, detuning the corresponding oscillator and producing a beat note. This beat note may be indicated by either headphones or an output meter operated from a detector or demodulator into which the two oscillator output signals are fed.

Figure 2 illustrates the basic arrangement of the Class-2 locator. A and B are radio-frequency oscillators feeding into the beat-note detector, C. The detector output is presented to an a-f (beat-note) amplifier, D, and thence to the headphones and output meter. The tank coil of oscillator A is supported rigidly outside of the instrument and functions as the search coil. The tank coil of oscillator B is self-contained. The two oscillators ideally are well shielded from each other to prevent interaction and pulling.

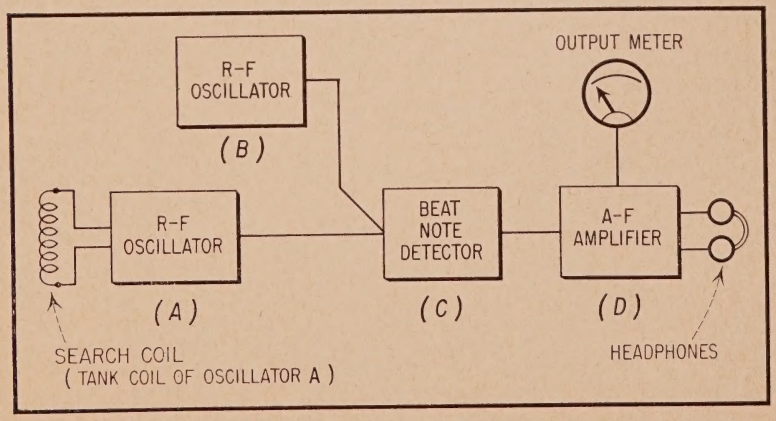



**Fig. 2. Basic Arrangement of Class-2 Locator.**

Initially, the two oscillators are set to zero beat through adjustment of a tank-circuit trimmer in either one, but usually oscillator B. At this point, no headphone signal can be produced and the output meter reads zero. If subsequently a piece of metal comes within the field of the search coil, it will alter the inductance of this coil as long as it remains in the field. This detunes oscillator A, producing a beat note equal to the difference between the two oscillator frequencies. The beat note is amplified, producing a headphone signal and output meter deflection.

In order to obtain a useful de-tuning effect, the oscillator operating frequency is higher than that employed in the Class-1 locator. It usually is of the order of 1 to 2 Mc. This has the added advantage that the coil can be made small in size in hand-held locators employed principally to spot conduit in walls and similar applications. Some operators prefer to set the adjustable oscillator for a continuous beat note (headphone and meter signal), rather than zero beat, an increase in pitch or rise of meter reading then indicating the presence of metal.

The Class-2 type of instrument is sensitive but does not have the penetrating depth of the Class-1 type. The reason for this is that the metallic body must be comparatively close to the coil in order to interact with its magnetic field and alter its inductance. This instrument accordingly is used principally to search out objects lying close to the surface, such as covered car tracks, sewer tops, bolts and nails under plaster, wiring in walls, etc. The beat-note type of operation is employed in some military mine detectors.

**Other Types.** Additional types of metal detectors not of the r-f variety, which will not be treated in this article, include a-f induction-balance systems and magnetic deflection types for ferrous metals only.

## Practical Circuits

Figure 3 shows the complete circuit schematic of a Class-1 metal locator which can be built by the experimenter. This instrument operates on 175 kc and is adapted from a popular earlier design.[3]

In this unit, the receiver employs two stages of tuned r-f amplification ($V_1$ and $V_2$), a germanium diode detector (D), and one stage of a-f amplification ($V_3$). Magnetic headphones are operated from the a-f amplifier, and a 0-100 d-c microammeter, M (as a signal strength indicator) from the rectified output of the diode detector.

The receiver is fix-tuned. Variable capacitor $C_2$, used as a trimmer, tunes the receiver loop coil, $L_1$. Capacitor $C_2$ is shunted by $C_1$ to bring the circuit capacitance up to the proper value required for resonance at 175 kc. The interstage coupling transformers ($T_1$ and $T_2$) are miniature, 175-kc i-f transformers with slug tuning. The capacitors shown across the primary and secondary windings of these transformers in Figure 3 are self-contained in the transformers. The receiver section of the locator is aligned simply by inductively-coupling an unmodulated 175-kc test oscillator or signal generator to the pickup loop ($L_1$) and adjusting $C_2$ and each of the i-f transformers for peak deflection of meter M. Increase the resistance setting of rheostat $R_1$ if the meter "pins."

Tubes $V_1$ and $V_2$ in the receiver must be shielded to prevent oscillation. The entire receiver section, including batteries $B_1$ and $B_2$, must be enclosed in its own metal box for efficient isolation from the transmitter. The pickup loop, $L_1$, must be provided with a Faraday shield to minimize capacitance effects. This shield may be constructed of thin sheet metal or foil wrapped around the finished coil. But the wrapping must be slotted, in the usual manner of a Faraday shield, so that it does not form a "shorted turn" around the coil.

Pickup loop $L_1$ consists of 40 turns of No. 22 enamelled wire closewound

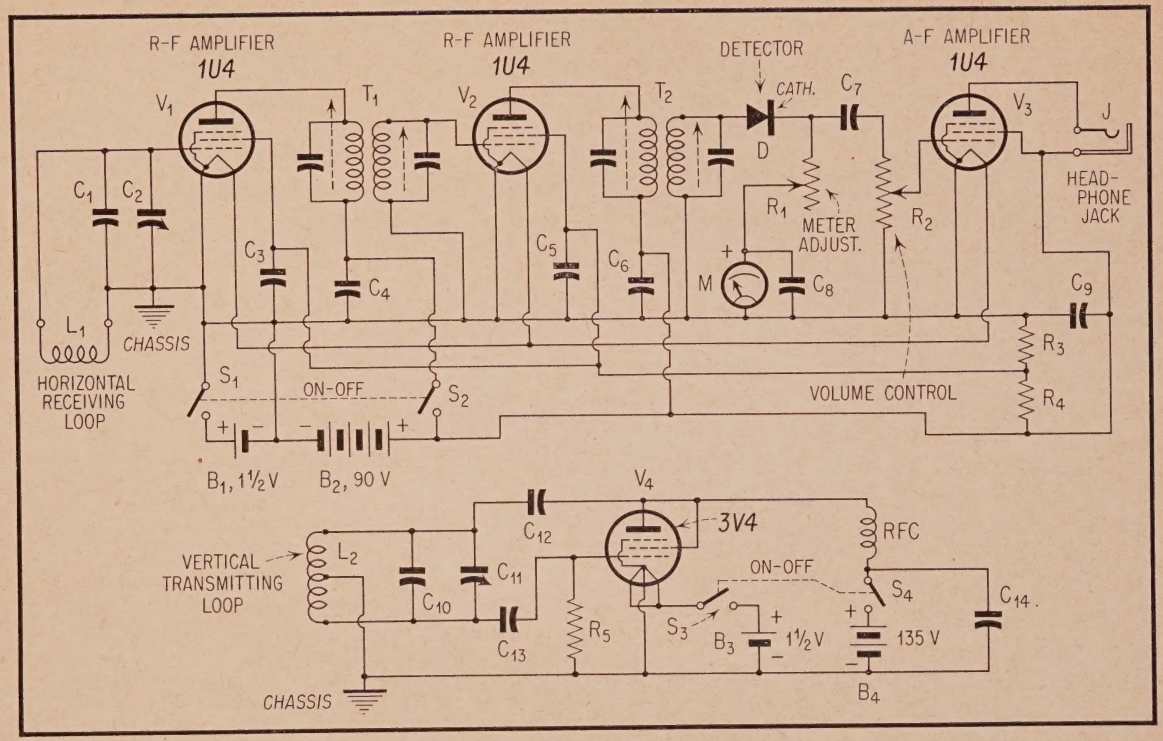



Fig. 3. Complete Schematic, Class-1 Metal Locator.

on a 1-ft-diameter plastic or impregnated-wood hoop.

The transmitter is fix-tuned by means of variable capacitor $C_{11}$. The latter is shunted by fixed capacitor $C_{10}$ to bring the circuit capacitance up to the value required for 175-kc resonance. A single 3V4 beam-power battery tube is employed in the shunt-fed oscillator-type of transmitter circuit. The transmitter loop, $L_2$, consists of 40 turns of No. 22 enamelled wire closewound on a 1-ft-diameter plastic or impregnated-wood hoop and tapped at the 12th turn.

The 3V4 is self-modulated at about 450 cycles by the high-resistance grid leak, $R_5$, which causes blocking action of the oscillator. This is very convenient for operation of headphones in the receiver but does not require a separate modulator stage. The modulation does not interfere with operation of the indicating meter, M. Both meter and headphones may be used simultaneously if this is desired.

The actual numerical value of the operating frequency is unimportant. For this reason, there is no need to set the instrument precisely to 175 kc. Indeed, the transmitter may be set arbitrarily to any frequency within the range of tuning capacitor $C_{11}$, a length of insulated wire looped around and run temporarily between antenna coils $L_1$ and $L_2$ for coupling, and the receiver aligned to this frequency by adjustment of $C_2$, $T_1$, and $T_2$.

In construction, the transmitter and receiver boxes must be mounted on opposite ends of the carrying pole. (See Figure 1.) The distance between the transmitting and receiving loops, which are mounted on the outsides of the corresponding boxes, must be

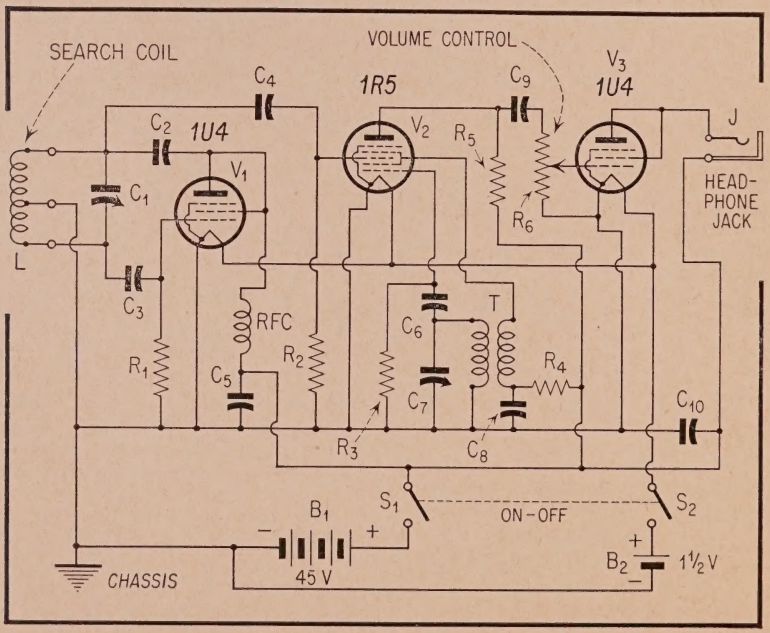



**Fig. 4. Complete Schematic of Class-2 Metal Locator.**

as great as practicable, never less than 2 feet.

Figure 4 shows the complete circuit schematic of a beat-frequency-type metal locator. In this arrangement, the 1R5 tube ($V_2$) is employed as a combination r-f oscillator and mixer. The first 1U4 tube ($V_1$) is the second oscillator. When these two oscillators are operating on the same frequency, $V_2$ has no output and the headphones are quiet.

The $V_1$ oscillator circuit contains the search coil, L. This coil is tuned by means of trimmer capacitor $C_1$, to set this oscillator to zero beat with the 1R5 oscillator tuned by $C_7$. The 1R5 feedback transformer, T, is self-contained and shielded, while coil L is external to the instrument and may be mounted on the outside of the instrument case or at the end of a pole. This coil consists of 60 turns of No. 26 enamelled wire closewound on a 4"-diameter plastic or cardboard form and tapped at the 20th turn.

When a metallic body enters the magnetic field of coil L, it detunes the 1U4 oscillator by changing the inductance of this coil. The frequency of this oscillator therefore shifts and an audio beat note is delivered by the 1R5 stage to the a-f amplifier ($V_3$) and headphones. Thus, a beat note signal in the headphones indicates the presence of metal near the search coil. As in the example of the Class-1 locator described previously, the search coil (L) of this unit should be provided with a Faraday shield to minimize capacitance effects.

The higher the operating frequency, the more pronounced will be the detuning introduced by small metal objects in the vicinity of the search coil. However, the frequency ordinarily is kept below 3 megacycles, in order to eliminate undesirable side effects such as radio interference, excessive sensitivity and instability, and susceptibility to body effects. With transformer T, a standard broadcast-receiver oscillator "coil," the operating frequency of the instrument will be approximately 1 to 2.2 Mc.

To set the unit initially: (1) Plug high-resistance magnetic headphones into jack J. (2) Close switch $S_1$-$S_2$. (3) With no metal near coil L, set tuning capacitor $C_7$ near its low-capacitance end. (4) In all probability, you will hear an audible beat note in the headphones at some setting of volume control $R_6$. (5) Adjust tuning capacitor $C_1$ for zero beat. (6) Now, bring a small piece of metal near coil L and observe that a beat note is heard as long as the metal is near.

In operation, capacitor $C_1$ or $C_7$ may be tuned to set the circuit to zero beat. Often, it will be necessary to re-zero as the instrument is "walked" over a varying terrain, and especially where rocks, vegetation, or water appear at intervals.

The beat-frequency instrument has considerably less sensitivity than the transmitter-receiver type. However, it is particularly useful for searching out nearby objects for that very reason. Furthermore, the beat-frequency-type locator can be constructed to a much smaller size than the transmitter-receiver type.

### Technique

The person who plans to use a metal locator of any type for whatever purpose must recognize that this instrument is incapable of making distinctions or of correlating and appraising the data which it senses. In short, it is only a tool and the role of interpretation is exclusive with the operator.

The locator cannot tell one kind of metal from another, although some locators (especially the beat-frequency type) sometimes can be adjusted so as to give an upward indication of an output meter with ferrous metals and a downward indication with non-ferrous ones. Nor can most locators distinguish between a mass of metal and a large pocket of highly-conductive water.

A great deal of skill is acquired by the operator strictly through the "feel" that comes with long practice in

handling the instrument. The alert and observant operator learns many peculiarities of his metal locator and, by the strength and quality of its output indications plus his familiarity with the environmental conditions under which he uses the instrument, he can tell many things about the detected metal — such things as probable size, depth of location, whether metal or water, etc.

## REFERENCES


1. Harold S. Renne, ELECTRONIC METAL LOCATORS (Howard W. Sams & Co., Inc., Indianapolis, Ind., 1956).

2. C. R. Shafer, **Choosing Industrial Metal Detectors,** ELECTRONICS, June, 1951.

3. Rufus P. Turner, **A Modern Metal Locator,** RADIO & TELEVISION NEWS, March, 1955.


## PARTS LIST FOR FIGURE 3

$B_1$, $B_3$—1½-volt cells

$B_2$—90-volt B-battery

$B_4$—135-volt B-battery

$C_1$, $C_{10}$—0.001 ufd silvered mica — (C-D 1R5D1)

$C_2$, $C_{11}$—140 uufd midget variable — (Hammarlund APC-140)

$C_3$, $C_4$, $C_5$, $C_6$, $C_7$, $C_9$—.01 ufd disc ceramic — (C-D BYA10S1)

$C_8$—0.002 ufd mica — (C-D 1W5D2)

$C_{12}$, $C_{13}$—0.004 ufd mica — (C-D 1W5D4)

$C_{14}$—0.01 ufd mica — (C-D 1D3S1)

D—Germanium diode — (Sylvania 1N34)

J—Open-circuit, insulated phone jack

$L_1$, $L_2$—Loop antenna coils — See Text

M—0-100 d-c microammeter

$R_1$—2000-ohm wirewound potentiometer

$R_2$—0.5-megohm poteniometer

$R_3$—47K 1-watt carbon

$R_4$—10K 1-watt carbon

$R_5$—2.7 meg ½ watt carbon

RFC—80 mh r-f choke — (Meissner 19-2709)

$S_1$-$S_2$—Dpst toggle switch

$S_3$-$S_4$—Dpst toggle switch

$T_1$—175-kc i-f input transformer — (Miller 012-K2)

$T_2$—175-kc i-f output transformer — (Miller 012-K4)

## PARTS LIST FOR FIGURE 4

$B_1$—35-volt B-battery

$B_2$—1½-volt cell

$C_1$—100 uufd midget variable

$C_2$, $C_3$—0.002 ufd mica — (C-D 1W5D2)

$C_4$—30 uufd mica — (C-D 5W5Q3)

$C_5$, $C_8$—0.01 ufd mica — (C-D 1D3S1)

$C_6$—50 uufd silvered mica — (C-D 22R5Q5)

$C_7$—Midget 365 uufd variable

$C_9$, $C_{10}$—.01 ufd disc ceramic — (C-D BYA10S1)

J—Open-circuit, insulated midget phone jack

L—Search coil — See Text

$R_1$—1 meg ½ watt carbon

$R_2$—0.5-megohm ½ watt carbon

$R_3$—100K ½ watt carbon

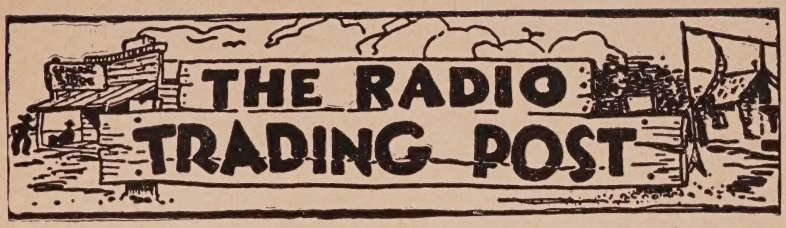
$R_4$, $R_5$—15K 1-watt carbon

$R_6$—0.5-megohm potentiometer

RFC—16 mh r-f choke — (Meissner 19-1995)

$S_1$-$S_2$—Dpst toggle switch

T—Broadcast oscillator coil — (Miller 71-OSC)

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**SELL** — Knight TV sweep gen. $30; Eico flyback & yoke tester $15; Eico bar gen. $10. All like new. Shipped FOB. or Express collect. Hume TV, 221 South Bon Air, Youngstown 9, Ohio.

**WANTED** — Globe King 500 B xmitter; HQ110 rcvr. Cash or trade complete 8mm camera and equipment & beautiful 4-year riding mare. L. P. Duncan, Palmyra, Va

**FOR SALE** — SCR-522 2 meter xceiver $25 and 12 volt dynamotor power supply $20; 2 vocaline citizen's band xceivers, $100. All in perf. cond. C. Waterman, Main St., Athol, Mass.

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**WANTED** — Glass dial plate or complete assembly for Philco table model AM-SW radio 41-240, Code 121. Reads 9.0 to 12.0 mc and 550 to 1700kc. Advise cash price. John A. Fels, c/o WTOP, 2021 University Blvd., West, Silver Spring, Md.

**WANTED** — FM tuners AM-FM table radios with or without cabinets. Advise make, model, and lowest price. Mercury Radio Service, 433 South Wabash Ave., Chicago 5, Ill.

**SWAP** — RCA test oscillator, for 16mm wide angel lens or what hove you in photo equip.? Jerry Zardo, 2158 Clinton Ave., Bronx 57, N. Y.

**WANTED** — for cash a TG34 or TG10 code keyer and some tapes, must be in good cond. Joe Szabat, 16 Pearl Ave., Oil City, Pa

**WANTED** — Heath: O-11 scope, 1B2 Impedance bridge, VC-3 voltage calibrator. John E. Jardine, 5214½ Tilden, Van Nuys, Calif.

**SELL OR TRADE** — Hallicrafters SX42 $150; SX71 $160; R46 spkr. with either rcvr $15. Or will trade both for HR060, Collins or TMC GPR 90 rcvr. Will ship FOB. S. E. Lipsky, 574 West End Ave., New York 24, N. Y.

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**WANTED** — TV sets 16" and larger in Brooklyn area only. B & E Radio & TV Shop, 2837 W. 17 St., Brooklyn 24, N. Y.

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**WANTED** — Leeds & Northrup type K Potentiometer, Weston standard cell, Wheatstone bridge, laboratory AC volt standards & amp standards. Will pay cash or trade electronic parts & equipment. Clarence Bigelow, 105 No. Main, Buffton, Ohio.

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**FOR SALE** — Audio Engineering mag. Oct — Dec '52, '53, '54 '55; Jan — Mar '56. All for $3.50 plus postage. J. P Andrasko, 223 E. 96th St., New York 28, N. Y.

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**URGENTLY NEEDED** — A 1930 model Philco Radio with "mystery" remote control for handicapped person. State price and condition. Sell: BC-645 converted to 450 Mc. $10. Herb Merrill, Down East Lane, Scarborough, Maine.

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**FOR SALE** — Heath V-5 VTVM $5; Eico scope 425 $15. Both instruments in perfect working order, prices plus postage. Ray Brown 8537 88th St., Woodhaven 21, N. Y.

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**WANTED** — RTTY equip., 10-20 beam tower accessories. Leo Meister, 321 River Rd., Nutley, N. J.

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**WANTED** — Dial asembly — for Meissner 8-C tuner. Have T-17 microphone and Electrovoice 915 microphone with desk stand — all chrome. C. Gabler, 1307 Merriam Ave., Bronx 52, N. Y.

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**FOR SALE** — Garrard RC-88 record-changer, new condition, $42.50; Cascade 2-speed disc-recorder radio-phonograph, $42.50; Pickering S-120M cartridge, portable radio and Alliance TV booster, $5. each, postage additional. Marilyn Phillips, 311 Penfield, Rockford, Ill.

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**FOR SALE** — GE self-charging portable radio, 3-speed record changer, Shure 737-A microphone, Pickering D-220 miniature diamond cartridge, $15. each, FOB. Mrs. Carolyn Gargen, 3007 Rice Ave., Rockford, Ill.

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**FOR SALE** — 1950 Dodge 807 car radio; Precision E400 sweep generator; Sonar MB26 2 meter transmitter and MR3, 3 band rcvr; 7" Motorola TV; Weston 777 tube tester; Meissner analyst. A. Turturro, 146-26 N. Hempstead Tpke., Flushing 55, N. Y.

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**WILL TRADE** — APECO Photoexact Copier and Electric Print-Dryer, perfect, $150 value, for new tubes, test equipment, recorders, TV, office equipment, guns, or what have you ? E. G. Bartlett, Atlanta, Mo.

**WANTED** — Power supply RA-74, 84, or 94. Sell or trade BC-645 rcvr-xmitter, Hammurland Super Pro rcvr., Dumont scope 241. All excellent. S. Consalvo, 4905 Roanne Dr., Washington 21, D. C.

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**FOR SALE** — Complete radio shop. Price $100. John W. White, 207 W. Cleveland St., Greenwood, Miss.

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**FOR SALE** — Precision E-200 AM gen. $45.; E-400 sweep gen. $75.; 4.5mc xtal, Simpson 260 with rt case, $35; Eico 425 5" scope, $39.50; Simpson 269 VOM, $60 with instructions. J. Pellock, 8643 Jennings, St. Louis, Mo.

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**SELL OR TRADE** — 500 Radio & TV tubes; UHF converter unit adapted for Philco TV installation $10; 7JP4 & 7EP4-Pix tubes; Todd check writer bank size $6. Andrews, 740 Maple St., Bethlehem, Pa.

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**WANTED** — For repair parts, damaged Hickok 533 tube tester. Also need ink recorder, prefer Sig. Corps. Type, to use with automatic keyer TG-10-A. Steve's Radio Service, Box 208 Wickes, Ark.

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**WANTED** — In any condition, Simpson 260 or Triplett 630 VOM. For sale 7EP4 $5. L. Menzi, 22-43 35th St., Long Island City, N. Y.

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**FOR SALE** — Eico deluxe 315 Precision sig. gen. perfect cond., $27.50. Will swap for Heath OM-2 or TS-4. Norman Iventasch, 320 E. 176 St., New York 57, New York

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**FOR SALE** — Precision E-299 Sig. Gen. $25; Heathkit WA-P2 Hi-Fi Pre-Amplifier $15; GE magnetic cartridge with .001" diamond stylus, $7.50; Jensen Tri-Plex speaker system, cross-over networks, level controls $120. All 1. n. L. F. Wagner, RD 1, Waterville, N. Y.

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**FOR SALE** — Rider's Manuals, Vols. 13, 14, NRI Service Manual Vol. 1. Will ship COD, PP, $20. De Voe Radio Service, 3729 Braumont Circle, Madison, Wis.

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**WANTED** — Program time clock, lantern slide projector, VOM, tube checker, pair citizens or marine transreceivers, antenna booster, adding machine, portable typewriter, AC gen., 6 v. to 110 AC alarm system, movie projector. Krzak, Pawtucket, R. I.

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**WANTED** — Measurements Corp., 65B and model 80 Sig. Gens. Send price and cond. James Paras, 355 E. Broadway, Salem, N. J.

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**SELL OR TRADE** — 16" & 20" Hyde Park console $55 and $70; 16" Philco table model $45. All in good cond or trade for Hi-Fi equipment. Local only. Scientific TV Shop, 1489 First Ave., New York 22, N. Y.

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**SWAP** — Complete set of agriculture books for back issues of IRE Proceedings, Electronics, or other electronic magazines. M H. Dean, 4616 Manchester Rd., Jacksonville 10, Fla.

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**FOR SALE** — Large Hi-voltage, variable input, CT power transformer, $3; radio receptor 6 henry choke, $3; two oil condensers, 2 mfd, 2,500 v., $2 each. Local. Milton Charnicki, 1129 Wheeler Ave., Bronx 72, N. Y.

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**FOR SALE** — Simpson 35 0-3 RF Ammeter, $7; Triplett 341-T 0-500 RF ma & 0-1 RF Amp., $5 ea.; model 90 dynamic mic. similar to E-V 600D, exc. cond. $15. Meters unused. Thomas L. Long, 12043 Claridge Rd., Wheaton, Md.

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**FOR SALE** — BC696, converted for 80, 40 and 20 CW-fone includes screen modulator and low pwr supply, 150 w. CW on 80 and 40. Excellent cond. No TVI. Highest offer. Weissenberg, 1142 Ryland Ave., Cincinnati 37, Ohio.

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**FOR SALE** — ARC-5, T-23, T-28, and MD-7 UHF trans. and rec. 100 to 156 mc. Rec. and Trans. converted for 12v operation. Rec. to continuous tuning, complete with racks and 12v dyna. H. N. McGregor, 22420 Argus, Detroit 19, Mich.

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**FOR SALE** — Photofacts folder sets 1 to 28 in A-1 cond., $15, plus $1 shipping or will ship by express. Frederick R. Shutt, 612 Frantz Ave., Mullens, W. Va.

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**SELL OR SWAP** — FM Powerline Carrier System per Radio TV News, Sept. — Oct. 1955. Two each rcvrs, 25 w. xmitters. Material cost over $300, exclusive of engineering, labor. Need Shopsmith Jointer, Bandsaw, Sprayer, minor accessories. J. J. Neil, 372 Rincon Ave., Livermore, Calif.

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**FOR SALE** — Power xformer 1,120 v. CT @ 500 ma.; 5 v. filament winding at 6 and 2 amps and 6.3 v. at 3 and 0.3 amp., $6.75; 1,000 assorted resistors, $8, S. S. Brody, 211-10 73rd Ave., Flushing 64, N. Y.

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**EXCHANGE** — First class printing for new radio tubes, test equip., radios, small TV, recorder. E. G. Bartlett, Box 134, Atlanta, Mo.

**FOR SALE** — Superior binding posts takes spade lugs, banana plugs, phone tips, lugs, or wire, 30 amp capacity, 100 black, 50 red, specify color, four for $1 FOB. Emil Backstrom, Jr., 5235 North Winthrop Ave., Chicago 40, Ill.

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**SELL** — Complete Argus C-3, case, flash, lens shade, filter adapter, instr. manual, l. n. cond., $45; Eico 221 VTVM, $15, factory wired, or flyback checker, or what have you? A. Consigilio, 679 East 240 St., Bronx 70, N. Y.

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**WANTED** — Lessons 10 and 11, Study Group 4 of RCA Color TV home study course. State price. F. Steele, 2725 Van Ness Ave., San Francisco 9, Calif.

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**SWAP** — Astatic & Regency boosters, meters, ARB rcvr, with ps and 1/4 hp. motors. Need metal locater, SW equipment. Thomas Rohland, Route 3, Martinsville, Ind.

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**WANTED** — Good compact, self-powered 110 v Phone Monitor, or custom built for ham station. Jos. Zukauskas, 2227 Germantown Ave., Philadelphia 33, Pa.

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**FOR SALE** — VFO Heathkit VF-1 assembled, reasonable; NRI Multitester (AC powered) with RF head; car radio for '46, '47, '48 Chevrolet. John C. Strazza, Jr., 48 Pulaski St., Bloomfield, N. J.

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**SELL OR SWAP** — Sonar XE-10 FM exciter. Mitchel Katz, 147-11 76th Ave., Flushing 67, N. Y.

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**FOR SALE** — RCA WO-56A 7" scope. Used slightly, $125, express collect. J. C. Boss, Rt. 2, Auburn, Ga.

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**FOR SALE** — 25 watt amplifier; GE self-charging portable radio; SW-54 communication receiver, all perfect cond. C. Horn, 325 E. 163 St., New York 51, N. Y.

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**FOR SALE** — Approx. 50 TV sets, 7" to 21". Some working, some not. Local only. See and make offer. B. J. D'Adolf, 1877 McKinley Ave., East Meadow, N. Y.

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**FOR SALE** — Eico 425 Push-Pull type 5" Oscilloscope. Built in 1956, used two months, excellent cond., $40. Dave Belanger, Whately, Mass.

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**FOR SALE** — Heathkit AT-1 xmtr., good cond., exc. novice rig, $22.50; 25 watt modulator with power supply, $15. Both $35. Aluminum 3 x 17 x 8" chassis in good cond., with bottom, $3.25. Bob Larson, 215 12th St., Wausau, Wis.

**WANTED** — Sweep generator and pocket-size scope, reasonable for cash. D. Ramirez, 103 W. 89th St., N. Y. 24, N. Y.

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**SELL OR TRADE** — Link police xmitter with control head, cables, etc., in good cond., on ten meters; Gonset 10 and 11-meter converter with noise clipper, $50. Gilbert Watson, 3008 Sansom Ave., Alabama City, Ala.

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**WANT** — Tape recorder or tape deck; mimeograph; multigraph; multilith; music type; typewriter. Trade amplifier, electric shaver, Argus camera, jig saw, motors, tubes, etc. Fred Keller, Memory Lane, Linlithgo, N. Y.

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**FOR SALE** — Antique radios, tubes and parts; Riders Trouble Shooters Manual Vol. I; diagrams and parts lists for old Philco radios. George Anderson, Box 305, Jamestown, Pa.

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**FOR SALE** — Globe King 500 push-to-talk xmitter, D104 mike and stand, and companion model 755 VFO, in excellent shape, $500 for all units ready to go on the air. Rig or all units sold separately. Amphenol 40 m. dipole to buyer. Mike Cerven, 6200 W. 95th St., Oak Lawn, Ill.

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**WANTED** — Recent NRI or RTTA professional TV servicing course. Will rent for 60 days if not for sale. Walter Fralick, 117 E. Bellville St., Marion, Ky.

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**FOR SALE** — 19" Motorola 19CTI color TV, in excellent cond., local only. Best offer over $225. Marstan TV Co., 13 Marcy Place, Bronx, N. Y.

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**SELL OR SWAP** — Unused Hickok 650 video generator, for UHF or VHF sig. generator, with microvolt control, and excellent accuracy and stability. Center Electronics, 867 Broad St., Center Falls, R. I.

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**SELL OR TRADE** — Dumont 208b 5" scope; books: Calculus by Granville, A-C Circuits by Kerchner, Measurements in Radio by Terman, Meter at Work by Rider. Make offer. Julian Scaruffi, 3321 N. Karlov Ave., Chicago 41, Ill.

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**SELL OR TRADE** — 2 perfect Philco UT-26 UHF converters less than net; Regency UHF converter, l. n. cond.; S & W 38 cal. revolver. Need test equipment. Luke Strader, 1217 Myrtle Ave., Danville, Va.

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**FOR SALE** — Riders manuals like new, Vols. 1-16 incl., $65. H. L. Ellis, 22031 Ridgedale, Oak Park 37, Mich.

**SELL OR SWAP** — Heath S-1 electronic switch improved to permit phase reversal of one input or normal presentation $20; 10" Emerson TV chassis less picture tube and 4 small tubes but including front of cabinet, $5. Local preferred. Martin A. Weiner, 2927 Holland Ave., New York 67, N. Y.

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**TRADE** — Fischer Diathermy machine, 3/4 Kw output, contains 2-HV-12's, 2-866's, 2KV pwr. sup. Need Eico Sweep Gen.; GDO; multimeter. Reginald W. Neale, 4001 Westside Dr., Churchville, N. Y.

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**SELL OR TRADE** — Dumont 274 5" scope, l. n. with manual, $50, or will trade for top quality Hi-Fi 3-speed changer or transcription player. G. E. Howarth, 216 1st Ave. East, Oskaloosa, Iowa.

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**FOR SALE** — Sylvania 216 sweep-CW generator, l. n., $69.50: AM, FM 80Kc-120 mc, fundamentals, 0.5%, features sweep alignment of hi-fi AM IF transformers. York, 114-38 196 St., St. Albans, N. Y.

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**FOR SALE** — Transistors NPN or PNP 50c each; small radios $2. ea. — with tubes, $4; 100 or more assorted kit-condensers, resistors, sockets, knobs, etc., $1.00 with order. George's Appliance-Repair, 3317 East St., Pittsburgh 14, Pa.

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**SELL OR SWAP** — Kenyon T 493 multimatch mod. transformer, 100-125 w, $10 each or 3 for $25 with instructions. Casey's TV Center, 169 Hall Ave, Perth Amboy, N. J.

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**WANTED** — Used rcvr. in good cond. which can pick up police, airplane, and boat calls. State lowest price. Martin Boxenhorn, 2946 W. 27 St., Brooklyn 24, N. Y.

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**SELL OR TRADE** — Hallicrafters SX100 receiver, excellent cond., $200 or will trade 6198 Vidacon tubes and deflection coils. Gregory Ehrler, 261 Arlington Ave., Brooklyn 8, N. Y.

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**FOR SALE** — 1955 Ford custom car radio, excellent cond. with new vibrator, $20. You pay shipping. John J. Sturek, 4170 Lynd Ave., Arcadia, Calif.

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**SELL OR TRADE** — Knight in-circuit condenser checker and Radio City model 480 VOM. Both $15. T. J. Harp, Gen. Del., Old Ocean, Texas.

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**WANTED** — Hallicrafter communication receiver SX-62A in good condition. Will pay up to $70. Clifton Johnson, R. 6, Box 950, Visalia, Calif.

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**WANT** — Vol. I, RCA's 'Pict-O-Guide" series. Wm. Kavanagh, 113-02 200 St., Hollis 12, N. Y.

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**FOR SALE** — Gemco-Iron-O-Meter electric irons tester, $15; Simpson 286 A.C. voltmeter, $7.50; 1/4" regular electric drill chuck, $1.50 plus postage. J. George, 1460 Grand Concourse, New York 57, N. Y.

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**FOR SALE** — Sams Photofacts Vols. 1-28, reasonable, like new. Glenn Glessner, Station WGEM, Quincy, Ill.

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**FOR SALE** — Pilotuner T-601 FM — radio converter, excellent condition, guaranteed, $12; unused 210, 250 and 281 tubes, make offer. Joseph L. Steinhagen, 15 Stratford Ave., Westmont 7, N. J.

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**SELL** —Heath VTVM, V6, Eico 1040, RCA 45EY2 phonograph, Hallicrafters T54 7" TV. Best offer. N. Marshall, 455 Washington Ave., Dumont, N. J.

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**FOR SALE** — Complete line of radio and TV tubes. Also general service equipment and parts. Cash for all or part. Blevins Radio & TV, 957 Main, Charlestown, Indiana.

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**FOR SALE** — Precision E200 signal generator, $20. Fred Wittich, 7202 Juniper Valley Rd., Middle Village 79, N. Y.

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**WANTED** — Receiver for 30-50 mc. State make, condition and price; also CQ for June 1957. James A. Nohe, 26 Vine St. Hillside 5, N. J.

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**WANTED** — Any one inch oscilloscope tube — prefer 1CP1. State cond. and price. Ernest Wolitzer, 2143 82 St., Brooklyn 14, N. Y.

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**SELL OR TRADE** — DZ-2 receiver 15-70 and 100-1750 Kc; 3 xceivers from ABA-1 (same as BC-645) for 420-500 Mc. Want 10-80 meter CW-voice transmitter. J. Ed Lockman, 2145 Brookview Dr., N. W., Atlanta 18, Ga.

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**SELL OR SWAP** — Dumont 175A lab. scope, single sweep, hi-low intensity etc., $100, or trade for Hickok 610 or RCA 55 sweep generator or 53 calibrator. J. Falotico, 1946 51 St., Brooklyn 4, N. Y.

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**SWAP** — Photographic equip. for double conversion rcvr such as NC183D, 75A, HRO, etc. Have 4 x 5 Omega enlarger; speed graphic; case, twin flash, filters, also 2 1/4 x 2 1/4 Zeiss Ikoflex, etc. Dwight McSmith, 500 Chapel St., Hampton, Va.

**SELL OR SWAP** — C-D Flyback transformer and yoke checker model BF80 for highest bidder. Lincoln Chase, Knoxville, Pa.

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**WANTED** — 1851 tubes any number. Robert J. Pastorino, 2816 Newport Rd., Ann Arbor, Mich.

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**FOR SALE** — RCP signal tracer 777A; 104 syncro-sweep gen., Oak Ridge, never used. Local only. S. Davis, 520 Powell St., Brooklyn, N. Y.

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**WANTED** — Complete Hickok 196 Trace-O-Meter in A-1 cond. C. de Grijze, 25 Bogart St., Brooklyn 6, N. Y.

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**WANTED** — "Leader" electro-magnetically operated antenna selector switch. Must be in new condition and operation. William H. Bell, 58 Central St., Wellesley 81, Mass.

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**FOR SALE** — S53A, $60; Harvey-Wells TBS-50-D with matching H-W VFO and H-W APS50 (115VAC) power supply, $221 value, $125 FOB. Jim Rourke, 181 Erie St., Cambridge, Mass.

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**FOR SALE** — Superior 450 tube tester, good condition, for panel mounting, 11" wide, 10½" high, 5" deep. Complete with instructions, $20 plus postage. Lowell Van't Slot, 12-28 Twelfth St., Fair Lawn, N. J.

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**FOR SALE** — Underwood typewriter, long carriage billing type, good condition, $10 cash. N. Y. vicinity only. D. Sweet, 138-35 Jewel Ave., Flushing, N. Y.

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**WANTED** — Heavy duty name brand rotator, bugs, handkeys, headphones and commercially built amateur receiver and transmitters. Bill Welsh, 306 Prospect St., Cambridge 39, Mass.

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**SELL OR TRADE** — Admiral automatic record changer 5RP47, needs crystal, $9.75 postpaid or trade for sig. gen., multimeter or two good AC-DC radios. Describe in full, all ranges, condition, etc. Ewell Churchill, Cord, Ark.

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**WANTED** — 5" scope; sweep gen.; in circuit cond. checker, good cond. and reasonable. David Simon, 3661 Nostrand Ave., Brooklyn 29, N. Y.

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**SWAP** — Feiler TS-3 stethescope, for 6-12 volt battery eliminator. R. F. Smith, R 2, Cambria, Va.

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**WANTED** — A good used scope in trade for Winchester 30-30 deer rifle. Anthony Kray, Putney, Vt.

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**FOR SALE** — Nearly new Eico 425 5" scope, $35; Meissner analyst, excellent cond., $40; Sam's Photofacts 50 through 213 and 16 binders, few in original envelopes, $140; Rider's 1 through 14, $35. Don Aden, 414 N. 39 St., Omaha, Neb.

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**WANTED** — Back issue ARRL Handbooks especially 1926-29, 37, 53 and all "Radio" handbooks. Will pay cash or swap others. Carl A. McKay, 4144 Meda Pass, Fort Wayne 6, Ind.

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**SELL OR TRADE** — BB1 Bogen booster; NRI 55 5" scope, needs repairs; NRI complete course less kits. Best cash offer or deal. John Fimiano, 814 W. Bruce St., Milwaukee 4, Wis.

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**FOR SALE** — GE TV test equipment, like new; Marker generator 4ST543; sweep generator ST-4A with balanced output adaptor; oscilloscope 4ST2A3. Make offer. Melvin Giles, Arapahoe, Neb.

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**FOR SALE** — NRI communications course complete with kits $40; VM 700 tape recorder, $65; Chicago-Webster 80-1 wire recorder with 8 spools wire, $30. Antenna rotor CDR TR-11, $12. All excellent cond. John Halchak, 391 Washington Ave., West Wyoming, Pa.

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**FOR SALE** — Webcor Imperial tape recorder with mike, $169.50; Collare RC-54 changer, plug-in head, $23.50; Brennel 3-speed tape deck and carrying case, requires preamp, $64; Electro-Voice Skylark speaker system, scratched cabinet, otherwise perfect, $49.50. M. Wiener, 17-42 166th St., Whitestone, N. Y.

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**FOR SALE** — BC 683 recvr. for house 110 v or 12 v 10-channel cry., calb. with sq. cont. and sensitivity cont. 27 to 39 Mc; BC 603 recvr., same as above but 20 to 28.9. Shipping wgt. 251bs. J. B. Murray, 12 Adams St., Charlestown 29, Mass.

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**FOR SALE** — Six master intercoms, 12 stations each. Executones 1230, good condition, $15 each plus postage. L. Cirrincione, 240-16 Weller Ave., Rosedale 22, N. Y.

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**TRADE** — Bar-dot gen; Heathkit; (3) 2E24 and 810 tubes and sockets; Meissner VFO; Hickok 288X; 15w amp; am-fm chassis; electronic switch; 20 meter conv. Want 813 phone xmitter and 2-meter gear. Josh Sanford, Reedsburg, Wis.

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**WANTED** — Cinema or Pultec program equalizer; also other professional recording equipment. Mark Novack, 157 Clark Rd., Brookline 46, Mass.

**SELL** — 300 VDC @ 250 ma power supply, $10; Amperite contact mike, $5; 45-spindle and cartridge shell for Garrard RC-80, unused, $3.50; Audiodisc 16" Chip-Chaser, $3.50; desk mike stand, $2. Donald P. Bagren, 417 N. Winnebaga, Rockford, Ill.

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**FOR SALE** — Hickok model 534; Riders 13, like new, $7. T. Bossbach, 13941 Kentucky, Detroit, Mich.

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**SELL OR TRADE** — Nine-tube comm. rcvr., 75kc to 18mc, BFO, audio filter, AVC, stand-by, self-contained speaker, black crackle finish case, for Heathkit Williamson amplifier. Gordon Soderlund, 9723B San Antonio Ave., South Gate, Calif.

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**SELL OR TRADE** — 128A's; 450TL's; 833A's, 4-250A's, 211H's, 804's filter condensers; HQ 129X; Central micrometers, etc. Want 75A4; 4-1000 A's; Millen G.D.M.; electronic key; test equipt.;etc. Hodge, Box 3221, Eastchester, Anchorage, Alaska.

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**SELL OR SWAP** — BC348J with ac supply; Telrad 18A freq. standard; MD7 modulator; PE-101C and DM35 dynamotors; Bud wavemeter. Want C-D TR2-4 rotator; HRO5 or 7; Johnson Matchbox; 15 meter beam. L. H. Carver, Cooks Shoes, Inc., Gainesville, Fla.

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**SELL OR SWAP** — DX-35 transmitter and Heathkit VFO, good cond.; Hallicrafter S-38D and Bendit transmitter with VFO, power supply and modulator. Interested in sound projector. Walter Ahern, 30-40 45th St., Astoria 3, N. Y.

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**SELL OR SWAP** — For TV experimenters RCA 6326 Vidicon tube, also 5876 high MU-5893 medium MU triodes, all unused. Make offer. Want SSB equip. W. A. Eubanks, 207 West Centennial Ave., Roosevelt, N. Y.

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**FOR SALE** — Weston oscilliscope model 983, like new, $115. Henry A. Kuck, 245-05 Union Turnpike, Bellerose 26, N. Y.

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**WILL BUY** — Good 5" scope, also Radio-TV sweep. Describe fully, your price, condition, leads, etc. John E. Doyle, Woodlawn Rd., Richwood Ave., Randolph, Mass.

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**FOR SALE** — Erie Ceramicons, 5, 7, 10, 15, 40, 50 and 200 mmf, 2c ea.; Plug-in electrolytics, 25 mfd, 350 v and 40 mfd, 25 v, 10c ea.; 70 assorted 600 v bathtubs, $7; 200 ohms 20 w ohmite, 7c ea. M. Levine, 2244 E. 27 St., B'klyn 29, N. Y.

**FOR SALE** — Eico 625 tube tester, $25 and Dayrad RF. sig. gen., $10, both A-1 cond.; Sylvania 17" TV chassis, needs some work, $10. Any make or model kit expertly wired at low prices. Irving Rosenthal, 53-05 92 St., Elmhurst 73, L. I. N. Y.

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**FOR SALE** — Rect. oil condensors, 10 mfd, 1000 v, $1.50 ea.; 10 mfd, 600 v, 85c ea.; 2 mfd, 2000 v, 95c ea.; 1 mfd, 2000 v, 65c ea.; 4 mfd, 1000 v, 90c ea.; 4 mfd, 600 v, 30c ea. Libby's 126 Bennett St., Port Richmond, Staten Island, N. Y.

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**SWAP** — Dumont model 208 5" scope, for good 35mm. camera. George C. Hodle, 4470 Wm. Penn Highway, Easton Pennsylvania.

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**FOR SALE** — Heathkit AR-2 receiver constructed and wired but never tested or aligned, $15 or ? Joe Wheeler, Jr., R 4, Cumming, Ga.

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**FOR SALE** — G.E. RPX 053A, $20; Pickering: 260DD, $35, D220, $15, D240, $25, 16" transcription arm, $20; Johnson Viking VFO kit, $25; Regency Transistor hand radio, $22, all unused. M. Bobbe, 275 East 168 St., Bronx 56, N. Y.

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**FOR SALE** — Parts and tubes for older model radio-phono-combinations — RCA, Philco, NU, Tung-Sol and GE. All unused in original cartons. List price plus postage; no c.o.d. Grayson Radio Electronics, 1211 W. Franklin Ave., Gastonia, N. C.

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**FOR SALE** — Riders 1-5 abridged and 6-20; also TV 1-5 in very good cond. Complete set of 21 vols. $125. Also 2 used Heathkit tube testers, good cond., $15 each. George Streitferdt, 2233 Mahoning Ave., Youngstown, Ohio.

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**FOR SALE** — RCA 50-A broadcast mike, low impedance, dynamic, perfect, $15. Gene Rider, 1810 Alamanda Drive, N. Miami, Fla.

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**FOR SALE** — Onan light plant, gasoline powered, 10,000 watt, good condition, in operation as stand-by. Ralph Taber, R. 5, Box 227, Terre Haute, Ind.

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**WANTED** — Communications equipment, i.e., Hallicrafters, National, for a ship's chronometer in excellent cond., value of $200. Local only. Alfred L. Isaacson, 3610 W. Sunnyside, Chicago 25, Ill.

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**FOR SALE** — Hammarlund Super Pro, SP 400X, good cond., $225. Cash and carry. Herbert T. Senter, 514 Jackson St., Joliet, Ill.

**WANTED** — Relay to handle 50-70 amps, 220 v with 110 v or 220 v coil that will break 3-phase line. Also want antique radios, phonographs in repairable cond.; 3 good 575 tubes. Milton Faivre, Box 1862, Tampa, Fla.

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**WANTED** — 7JP4 picture tube, good cond. State price. A. T. Bean, 302 S. Kent St., Winchester, Va.

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**FOR SALE** — Precision 612 tube tester slightly used, $50; RCA unused tubes 5U4, 2-654, 2-12AT7, 4-6J6, $7. Angelo Crudele, 17 Lake Ave., Clifton, N. J.

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**SELL OR TRADE** — BC-223 trans., 4 xtal chan., 2 to 3 Mc., incl. dynamotor, PE-103 dynamotor, for communications receiver. Louis F. Rodman, 842 E. Cambridge, Burbank, Calif.

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**SELL OR TRADE** — Photoelectric amplifier with 10,000 ohm relay, battery powered, made to dim lights in car. Good cond., mounted in metal box, $10 or trade for Radi-Vox, wireless microphone for 1 mile or more. Earl Burden, R. 2, Powell, Tenn.

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**FOR SALE** — Seco GCT-5 grid circuit tube tester; 1956 model used less than month, $18, postage prepaid. G. J. Murray, 745 S. Humphrey, Oak Park, Ill.

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**FOR SALE** — R-J speaker enclosure F15M, mahogany floor cabinet for 15" speaker, including 12" adapter, $25; UTC LS-21 and LS-25 audio transformers and Chicago PCC-150 power transformer, $4 each. Excellent condition. FOB. Jack Atkins, 1375 27 St., Ogden, Utah.

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**SELL OR TRADE** — 4 x 5 Crown Graphic set, automatic Rolleiflex and SX-25. Want NC 183D or HRO 60; also ham and lab test equipment. Joseph Marshall, Jr., 22 Clare Drive, East Northport, N. Y.

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**FOR SALE** — Portable emergency radio transmitter TPC-119 for marine boats, fishing etc., $15 FOB. M. A. Colbert, 310 West 93 St., New York 25, N. Y.

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**FOR SALE** — Lysco 600, 40 w. CW xmitter, VFO and xtal-controlled, TVI suppressed; Eldico 40 w. modulator with power supply; Heath AT-1 xmitter, with or without modulator; McElroy code oscillator. Bob Hartman, Dakota, Ill.

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**FOR SALE** — Rider's Manuals — TV 5, PA 1, Radio 1, 3, 4, 6 thru 13, 15, 17, 20. Also asst. radio and TV test equip. Duke Mann, 311 Main St., Schoharie, N. Y.

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**SELL OR TRADE** — BC-348-Q with phones, speaker, S meter; ART-13 with built-in 10 meter converter, power supplies, $75 each. Will trade both for stacked-head stereo tape deck. Lt. Oliver W. Fix, 81 Dona Ana Loop, Holloman AF Base, New Mexico

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**WANTED** — Tape recorder; tube tester; mult, meter; Sams Photofacts. Will swap hi-fi speakers crossovers; record players; AM-FM tuner, diamond cartridges, etc. Ralph Pithart, General Delivery, Sacramento, Calif.

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**FOR SALE** — Hallicrafters SX-88 receiver, 2nd. production run, excellent cond., $350. FOB Atlanta; Gonset noise limiter like new, $4.50. Bob Sturman, 3221 E. Harrington Dr., Decatur, Ga.

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**FOR SALE** — Mosley VPA 20-3, used only 3 days, $25, local only; GE RPX 061A cartridge with single diamond, l. n., $12. M. Weinberg, 987 E. 178 St., New York 60, N. Y.

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**FOR SALE** — Hallicrafters S40-B, l. n., $50; Heathkit antenna tuner, $12. Howard B. Haftel, 1651 Montgomery Ave., Bronx 53, N. Y.

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**FOR SALE** — Altec-Lansing A-433-A remote amplifier and matching A-333-A power amplifier, exc. cond., $80 FOB. J. Phennicie, Jr., Box 55, Norway, Iowa.

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**WANTED** — Semi-automatic key, i.e., "Bug" in working order, $3 to $7 depending on condition. David Kitrosser, 23 Oakland St., Lexington 73, Mass.

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**UNWANTED** — Obsolete radio equip., books, mimeographs, typewriters, printing presses,, type, etc., can be put to further use by a shut-in. Keller, Memory Lane, Linlithgo, N. Y.

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**FOR SALE** — Back issues of technical journals and technical books. Send for list. W. Skalski, 280 Carlton Ave., East Rutherford, N. J.

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**FOR SALE** — Precision 10-20P tube and set tester, complete; NRI Professional TV servicing course, complete; Heath V-7 VTVM, like new. Make offer. Milan Rafayko, 180 Winston, Lexington, Ky.

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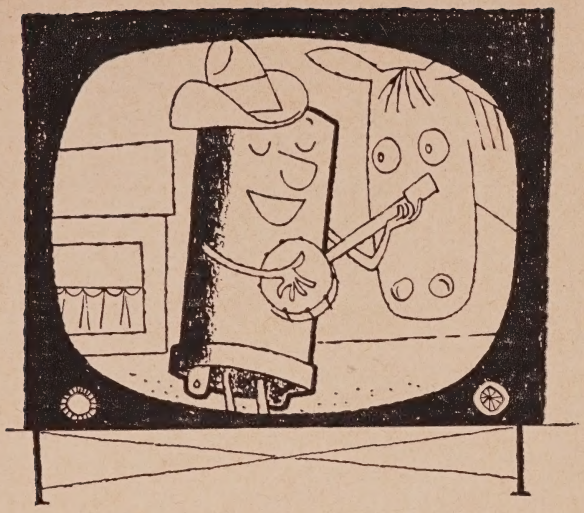
**WANTED** — Harvey-Wells Bandmaster Sr. xmitter, Bandmaster VFO and APS-50 AC power supply, 80 thru 2 mtrs. Will trade 1948 Harley-Davidson, with all extras, A-1 condition, value $300. Henry K. Shirley, 4373 S. Orchard Dr., Decatur, Ga.



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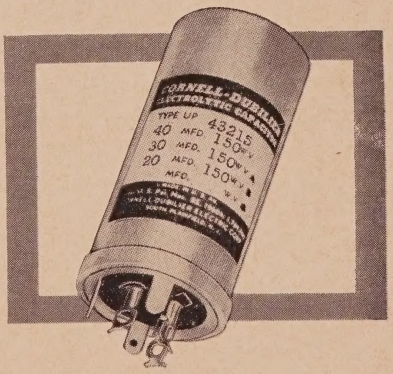


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